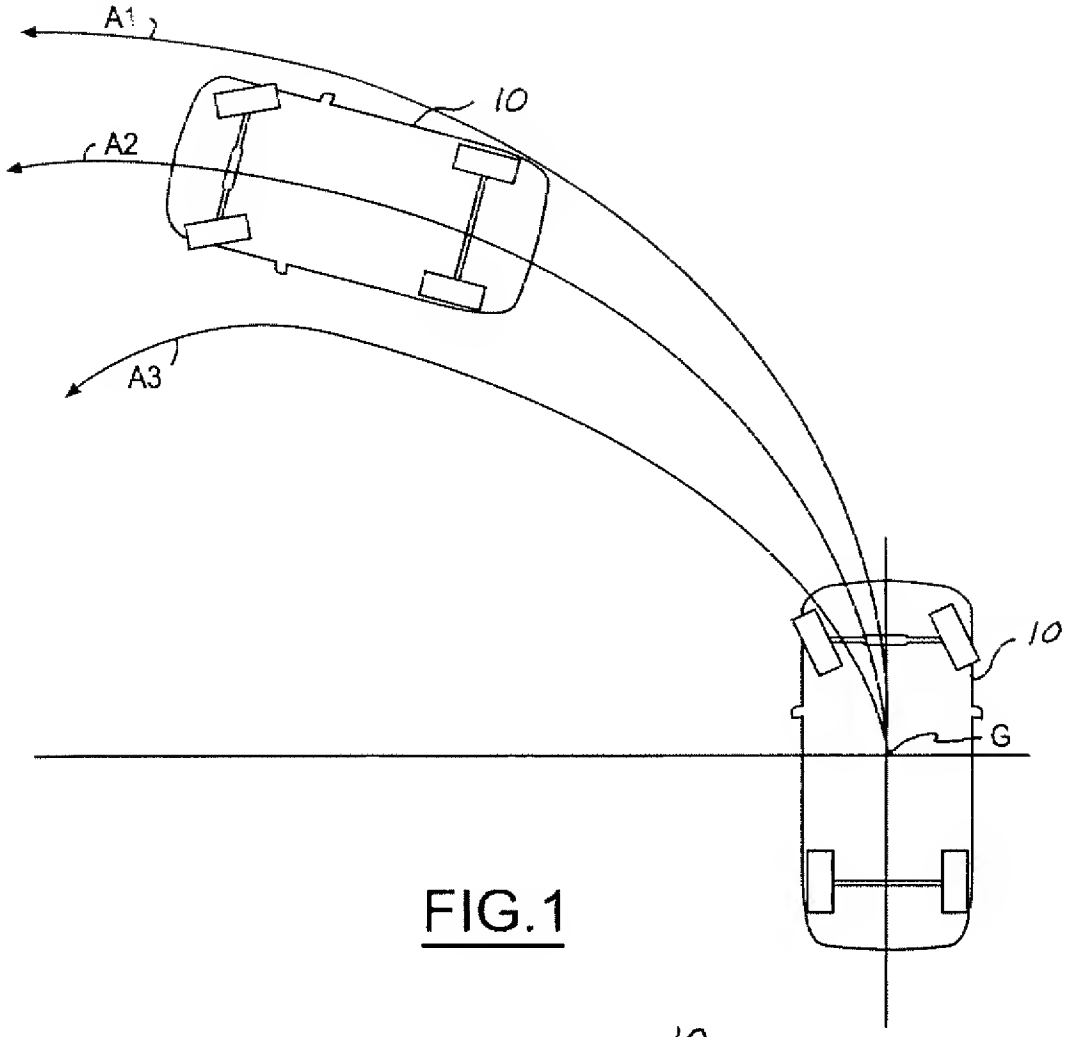

A1
A2
A3
10
10
G

FIG.1

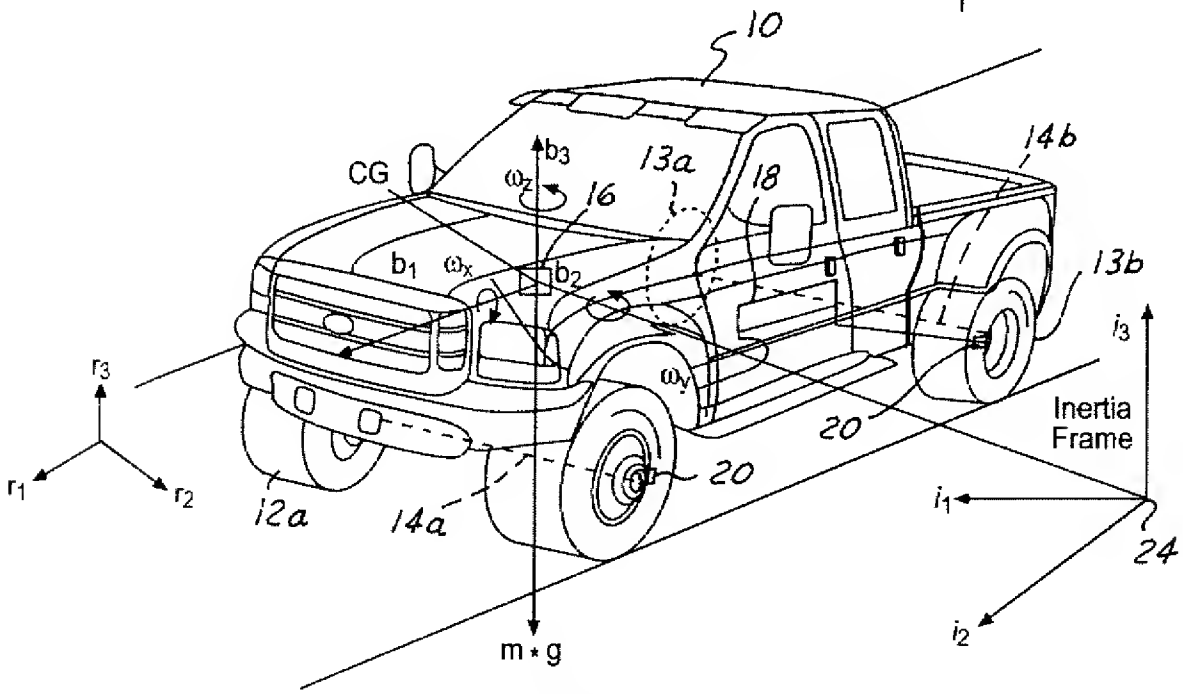

10
CG
b3
ω2
16
13a
18
14b
b1
ωx
b2
13b
i3
r3
ωy
Inertia
Frame
20
r1
r2
20
12a
14a
24
i1
i2
m * g

FIG.2

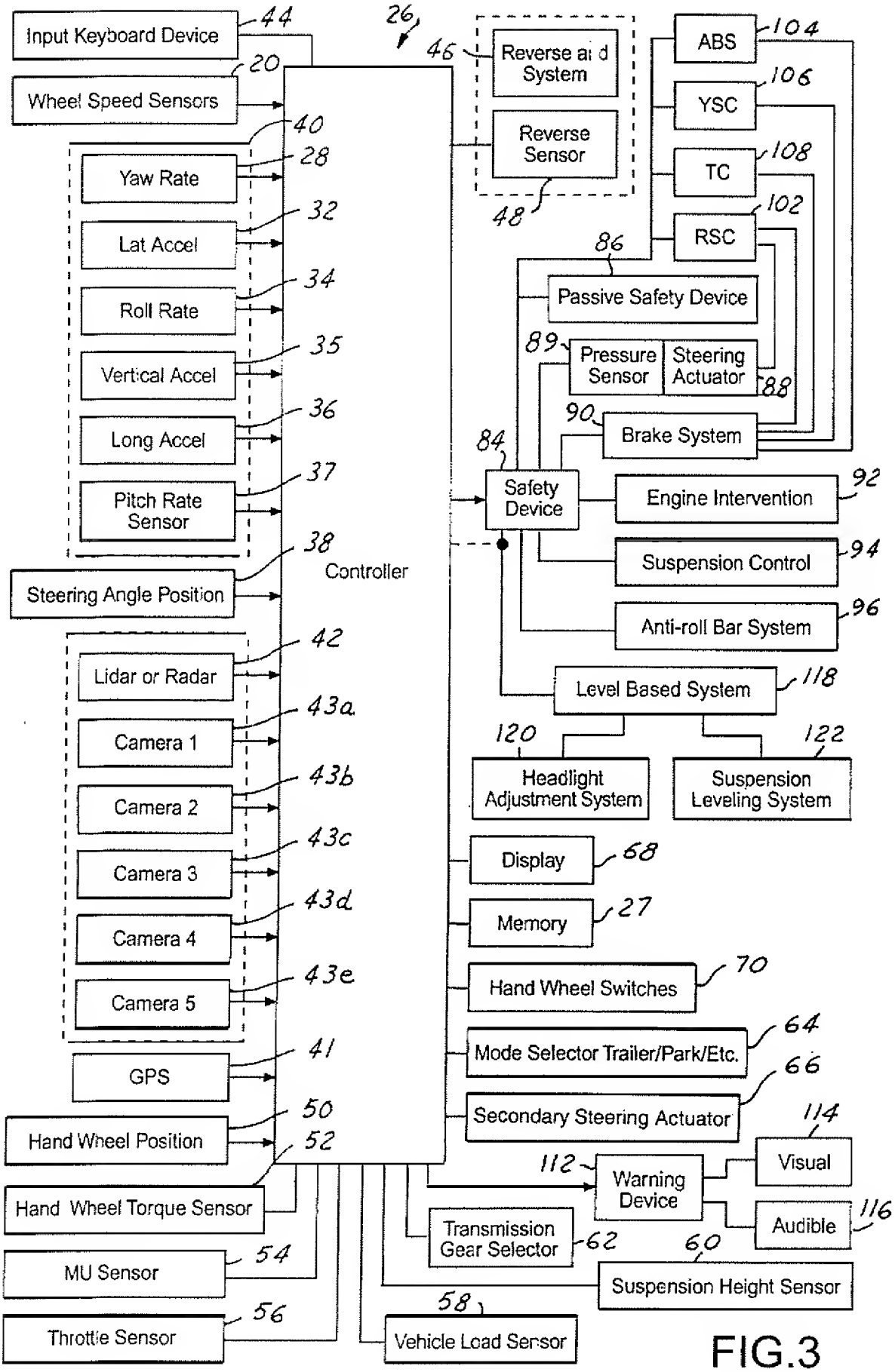

Input Keyboard Device
44
26
Wheel Speed Sensors
20
46
Reverse aid System
Reverse Sensor
48
ABS
104
YSC
106
TC
108
RSC
102
40
Yaw Rate
28
Lat Accel
32
Roll Rate
34
Vertical Accel
35
Long Accel
36
Pitch Rate Sensor
37
86
Passive Safety Device
89
Pressure Sensor
Steering Actuator
88
90
Brake System
84
Safety Device
Engine Intervention
92
Suspension Control
94
Anti-roll Bar System
96
Level Based System
118
120
Headlight Adjustment System
122
Suspension Leveling System
38
Controller
Steering Angle Position
42
Lidar or Radar
43a
Camera 1
43b
Camera 2
43c
Camera 3
43d
Camera 4
43e
Camera 5
Display
68
Memory
27
Hand Wheel Switches
70
Mode Selector Trailer/Park/Etc.
64
66
Secondary Steering Actuator
114
Visual
112
Warning Device
Audible
116
GPS
41
Hand Wheel Position
50
52
Hand Wheel Torque Sensor
Transmission Gear Selector
62
60
Suspension Height Sensor
MU Sensor
54
Throttle Sensor
56
58
Vehicle Load Sensor

FIG.3

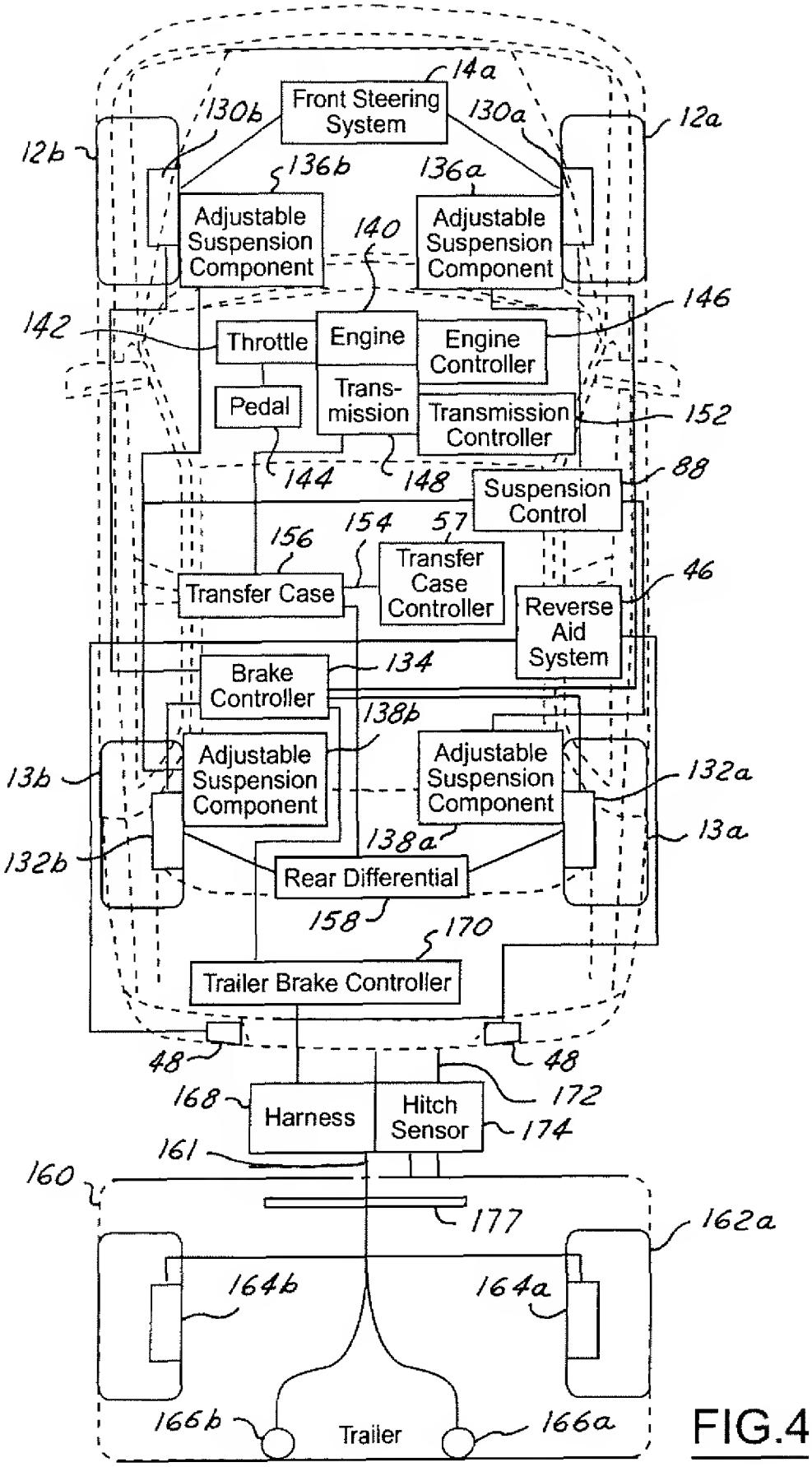

14a
Front Steering System
130b
130a
12b
12a
136b
136a
Adjustable Suspension Component
140
Adjustable Suspension Component
146
142
Throttle
Engine
Engine Controller
Pedal
Trans-mission
Transmission Controller
152
144
148
88
Suspension Control
154
57
156
Transfer Case Controller
Transfer Case
46
Reverse Aid System
Brake Controller
134
138b
Adjustable Suspension Component
Adjustable Suspension Component
13b
132a
13a
132b
138a
Rear Differential
158
170
Trailer Brake Controller
48
48
168
Harness
Hitch Sensor
172
174
161
160
177
162a
164b
164a
166b
Trailer
166a

FIG.4

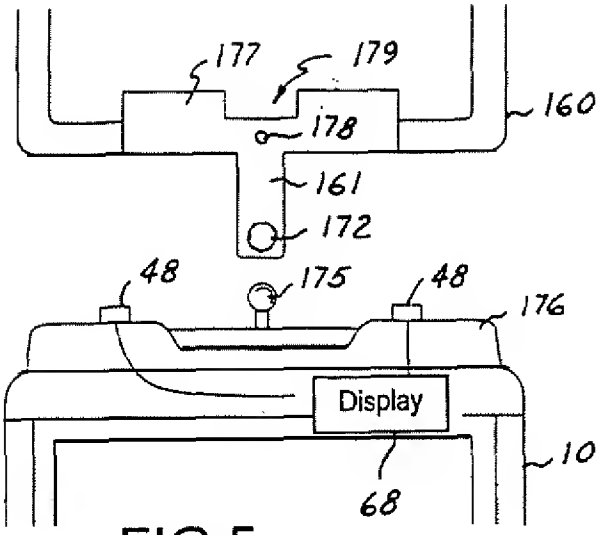


FIG.5

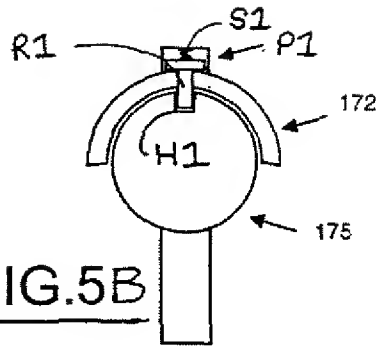
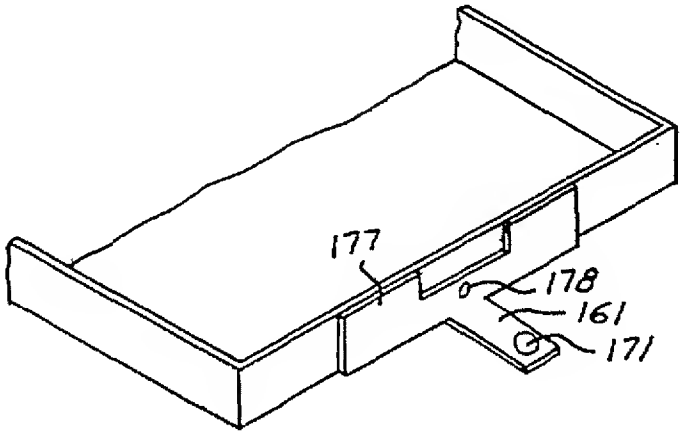


FIG.5B

FIG.5A



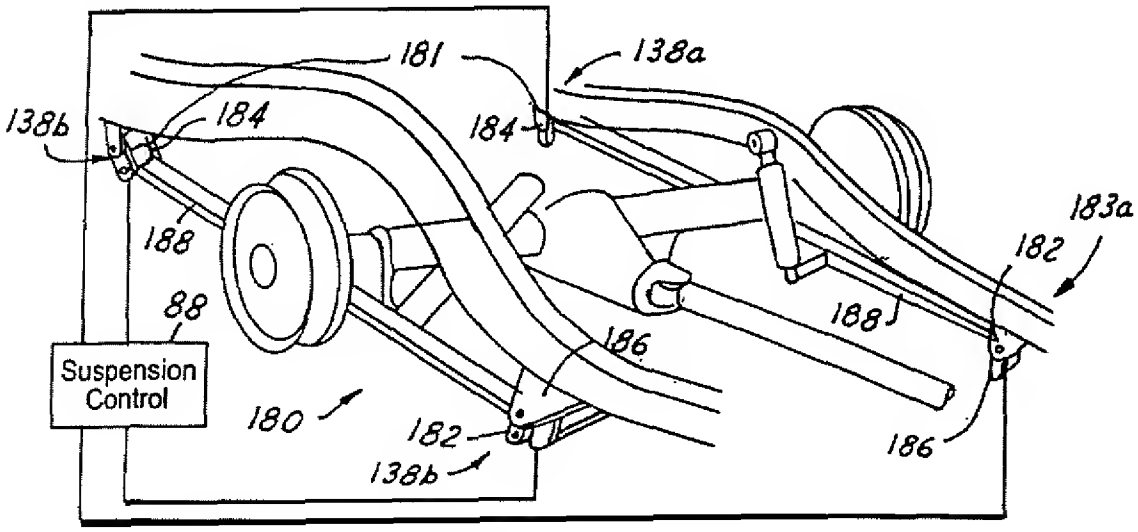


FIG.6

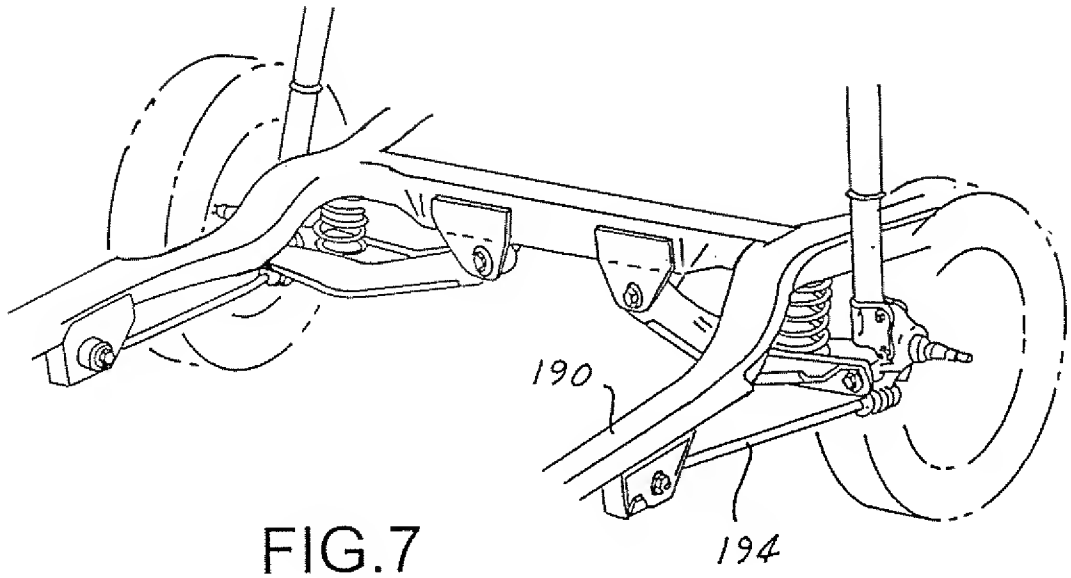


FIG.7

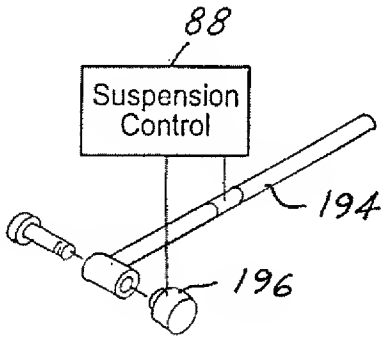


FIG.8

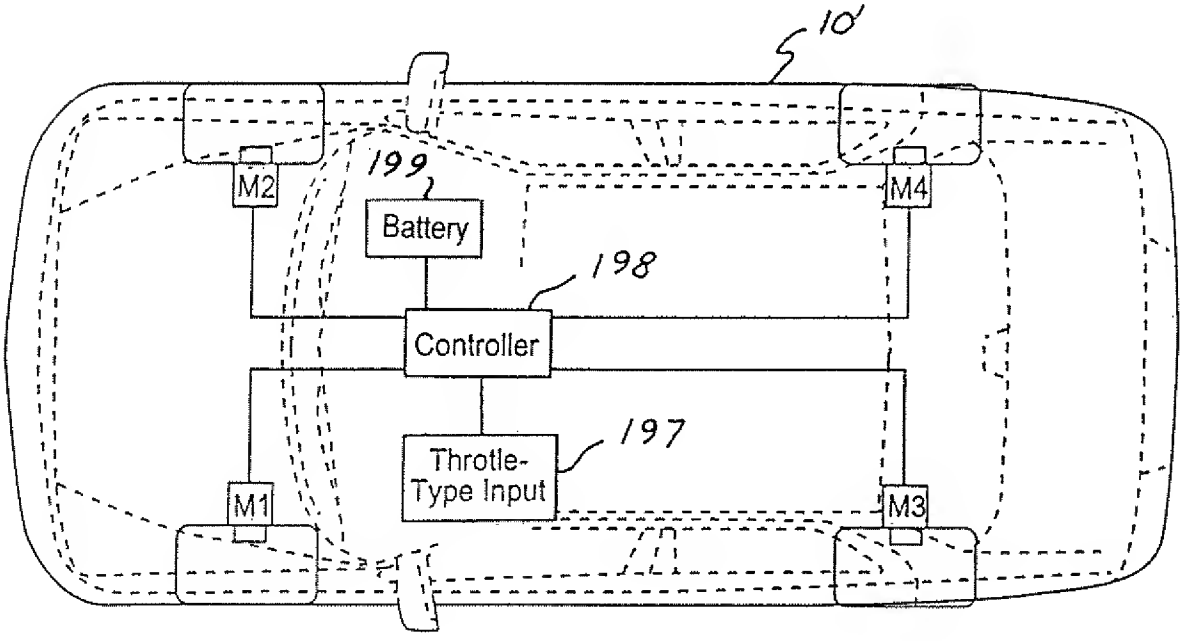


FIG.9

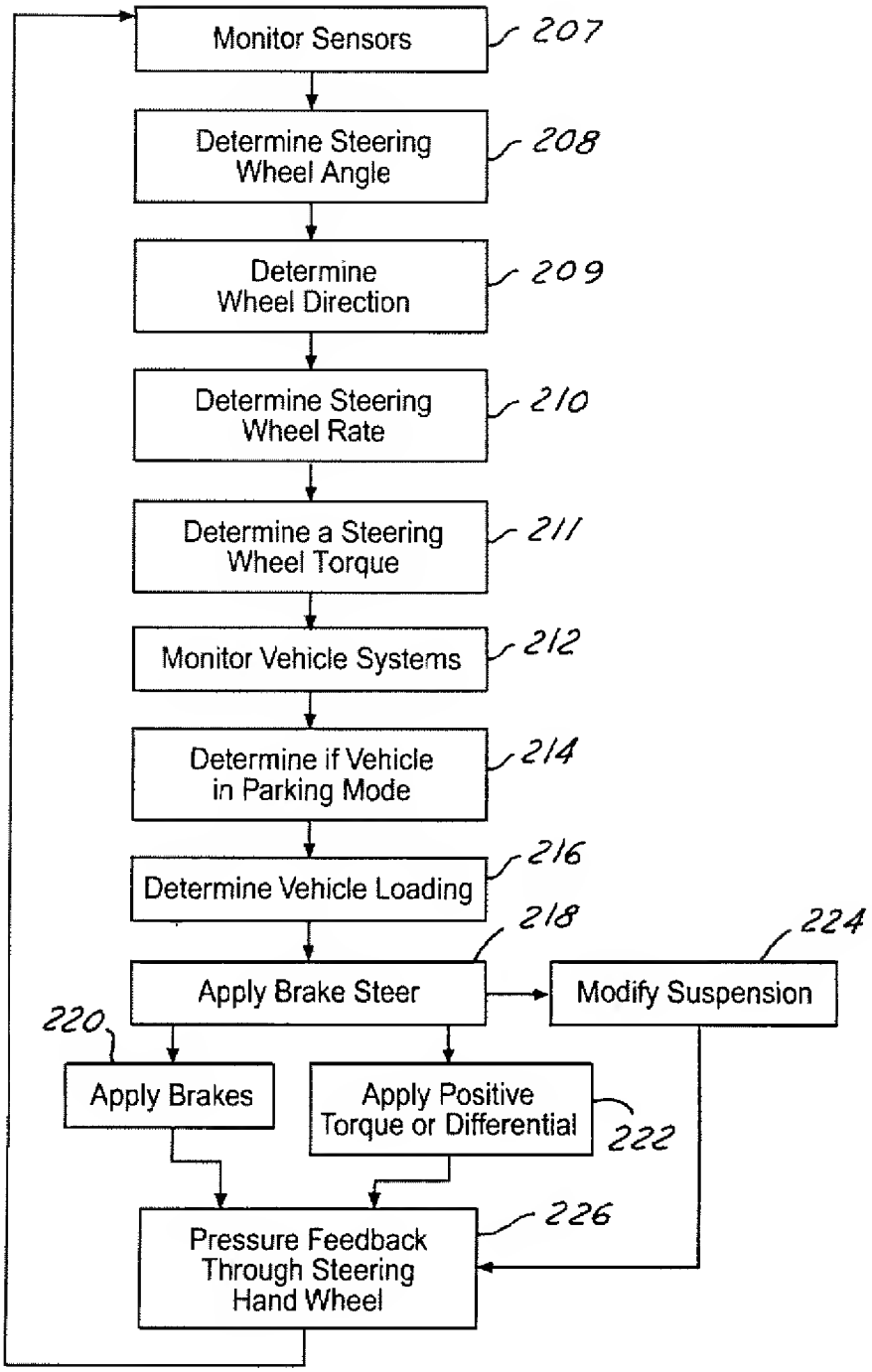

Monitor Sensors
207
Determine Steering Wheel Angle
208
Determine Wheel Direction
209
Determine Steering Wheel Rate
210
Determine a Steering Wheel Torque
211
Monitor Vehicle Systems
212
Determine if Vehicle in Parking Mode
214
Determine Vehicle Loading
216
218
Apply Brake Steer
224
Modify Suspension
220
Apply Brakes
Apply Positive Torque or Differential
222
226
Pressure Feedback Through Steering Hand Wheel

FIG.10

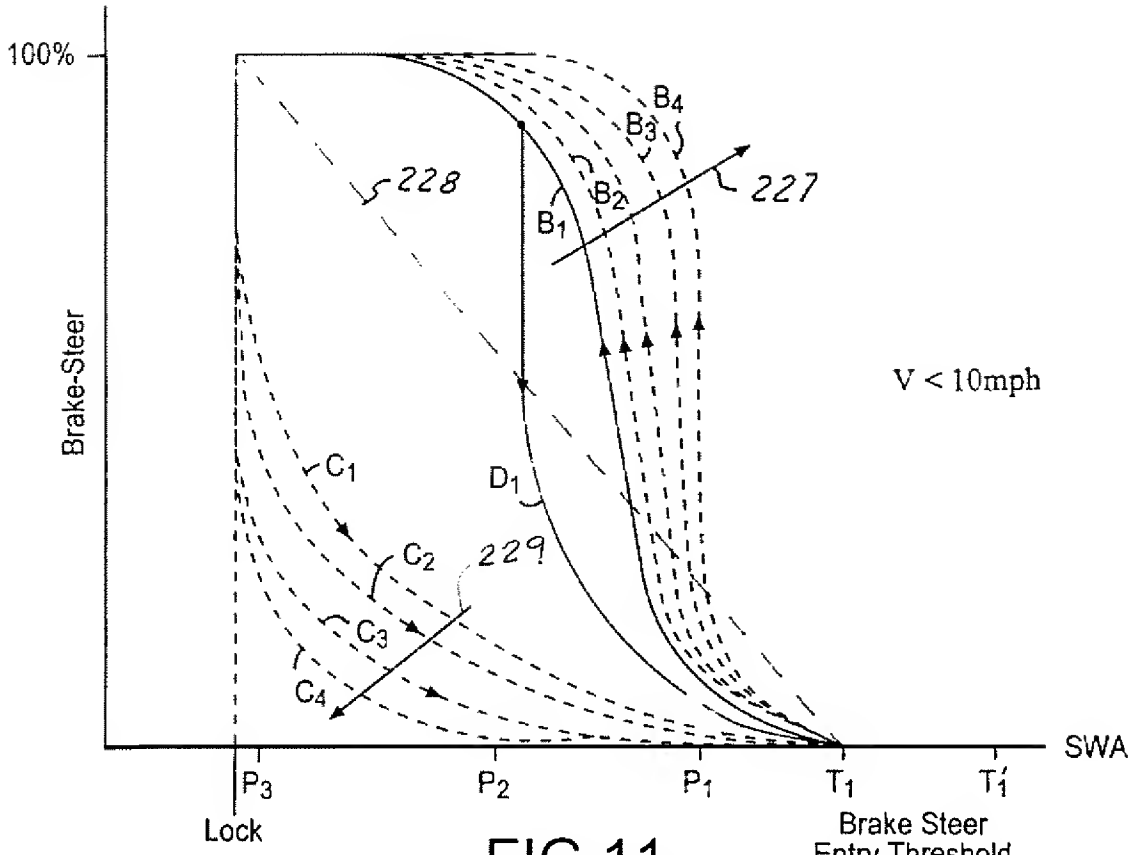

100%
Brake-Steer
B4
B3
B2
B1
228
227
V < 10mph
C1
D1
C2
229
C3
C4
SWA
P3
P2
P1
T1
T1'
Lock
Brake Steer
Entry Threshold

FIG.11

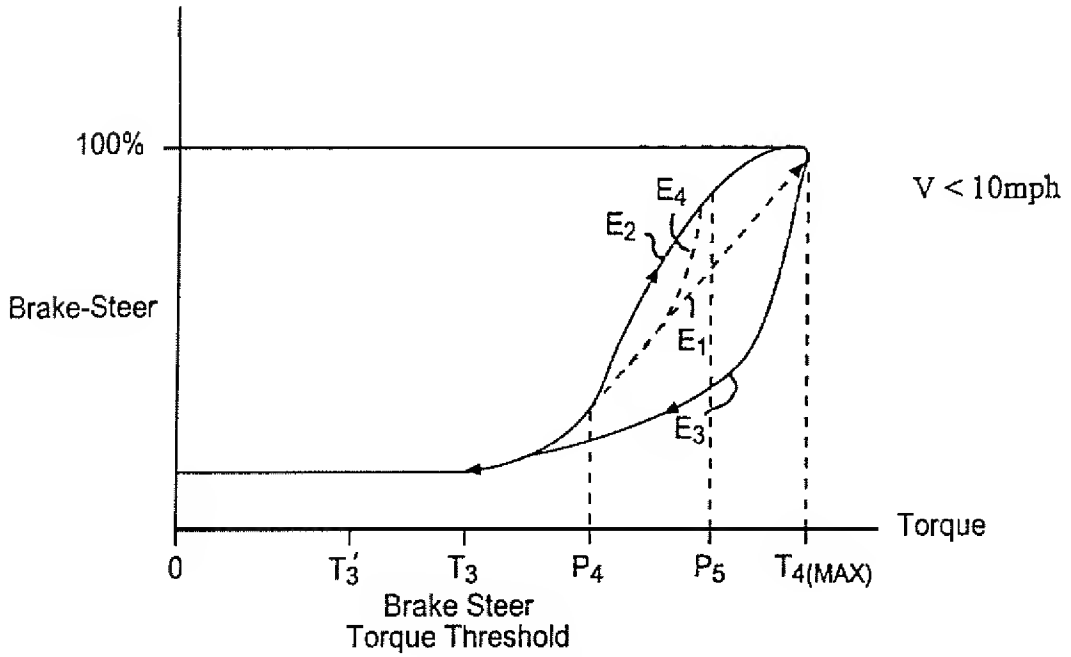

100%
Brake-Steer
E4
E2
E1
E3
V < 10mph
Torque
0
T3'
T3
P4
P5
T4(MAX)
Brake Steer
Torque Threshold

FIG.12

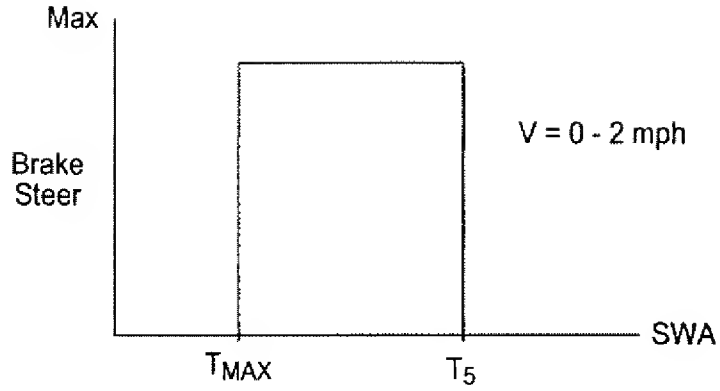


FIG.13

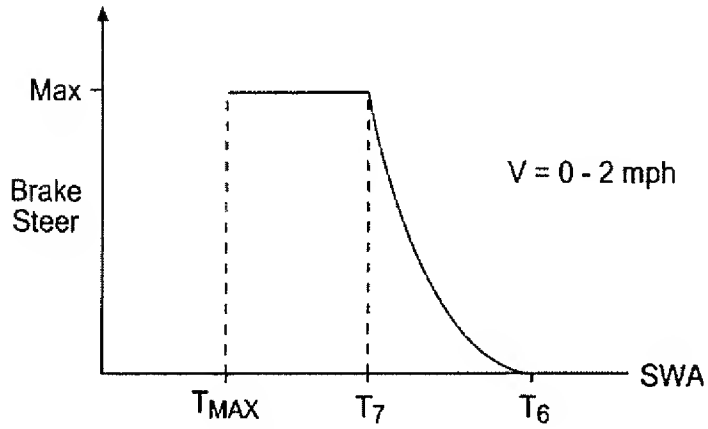


FIG.14

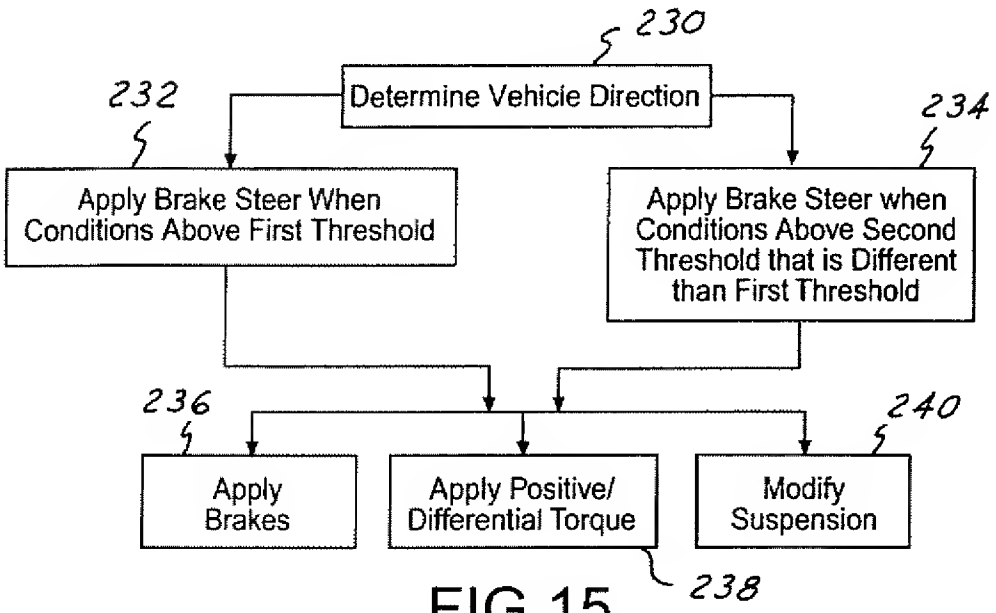


FIG.15

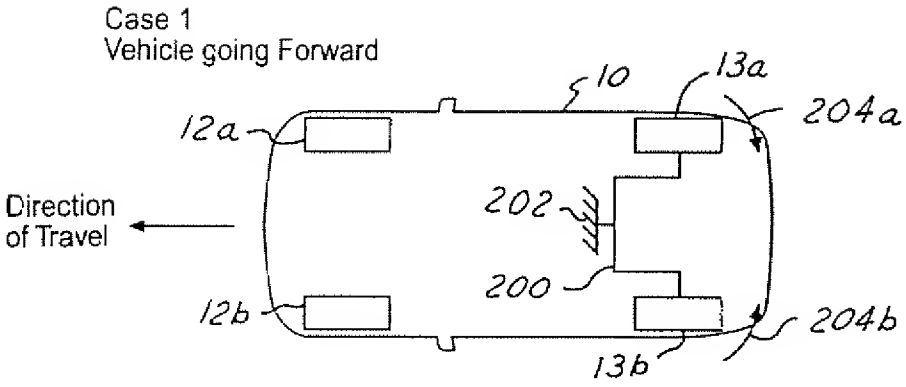


FIG.16

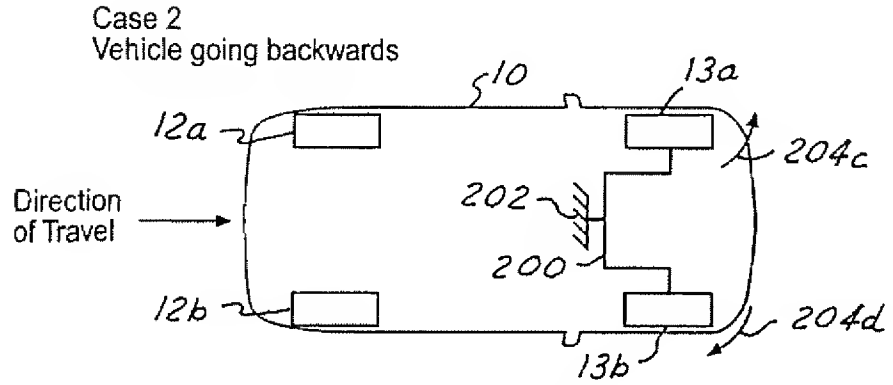


FIG.17

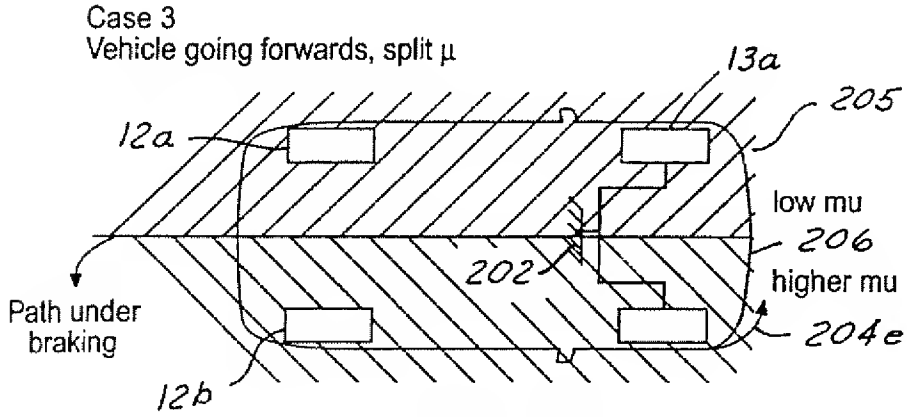


FIG.18

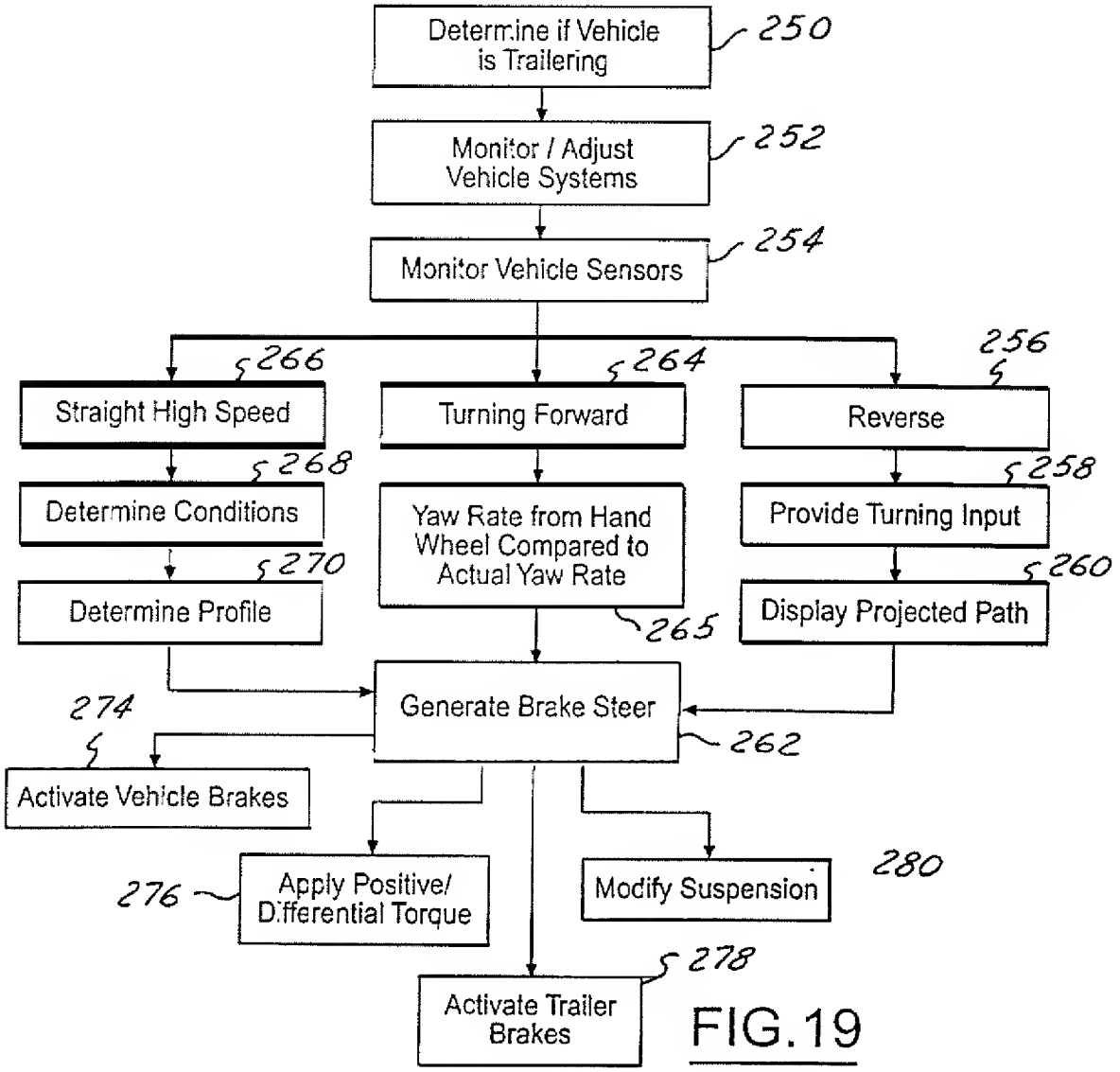

Determine if Vehicle is Trailering
250
Monitor / Adjust Vehicle Systems
252
Monitor Vehicle Sensors
254
256
266
264
Straight High Speed
Turning Forward
Reverse
268
258
Determine Conditions
Yaw Rate from Hand Wheel Compared to Actual Yaw Rate
Provide Turning Input
270
260
Determine Profile
265
Display Projected Path
Generate Brake Steer
274
262
Activate Vehicle Brakes
276
Apply Positive/ Differential Torque
Modify Suspension
280
278
Activate Trailer Brakes

FIG.19

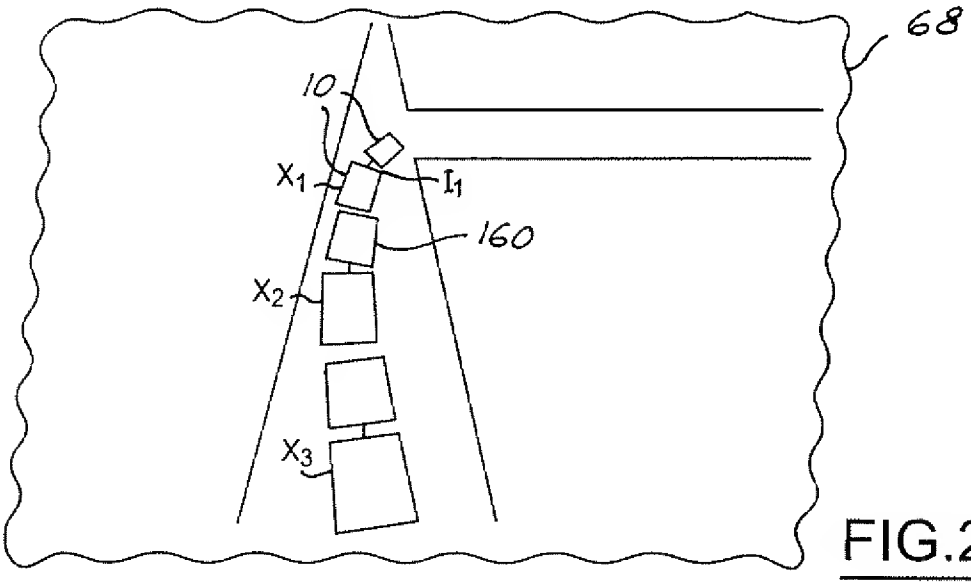

68
10
X1
I1
160
X2
X3

FIG.20

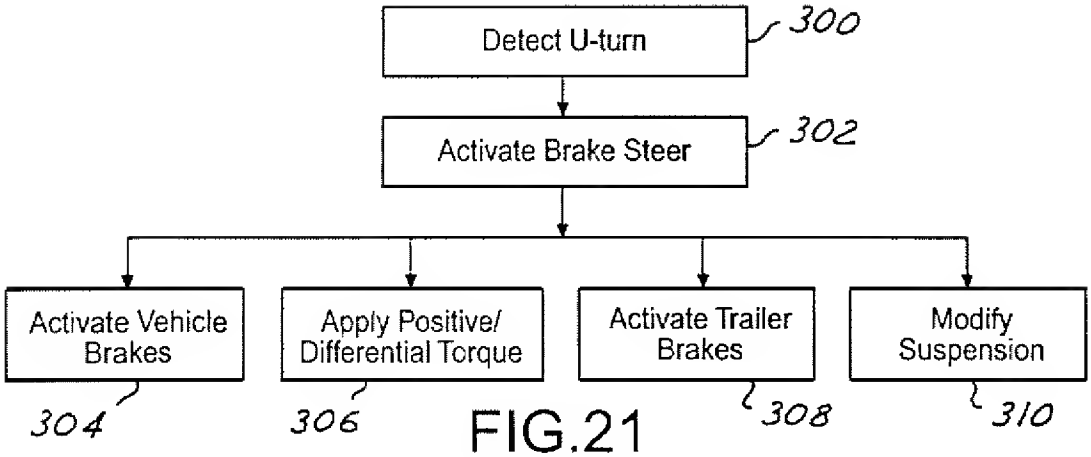

Detect U-turn
300
Activate Brake Steer
302
Activate Vehicle Brakes
304
Apply Positive/ Differential Torque
306
Activate Trailer Brakes
308
Modify Suspension
310

FIG.21

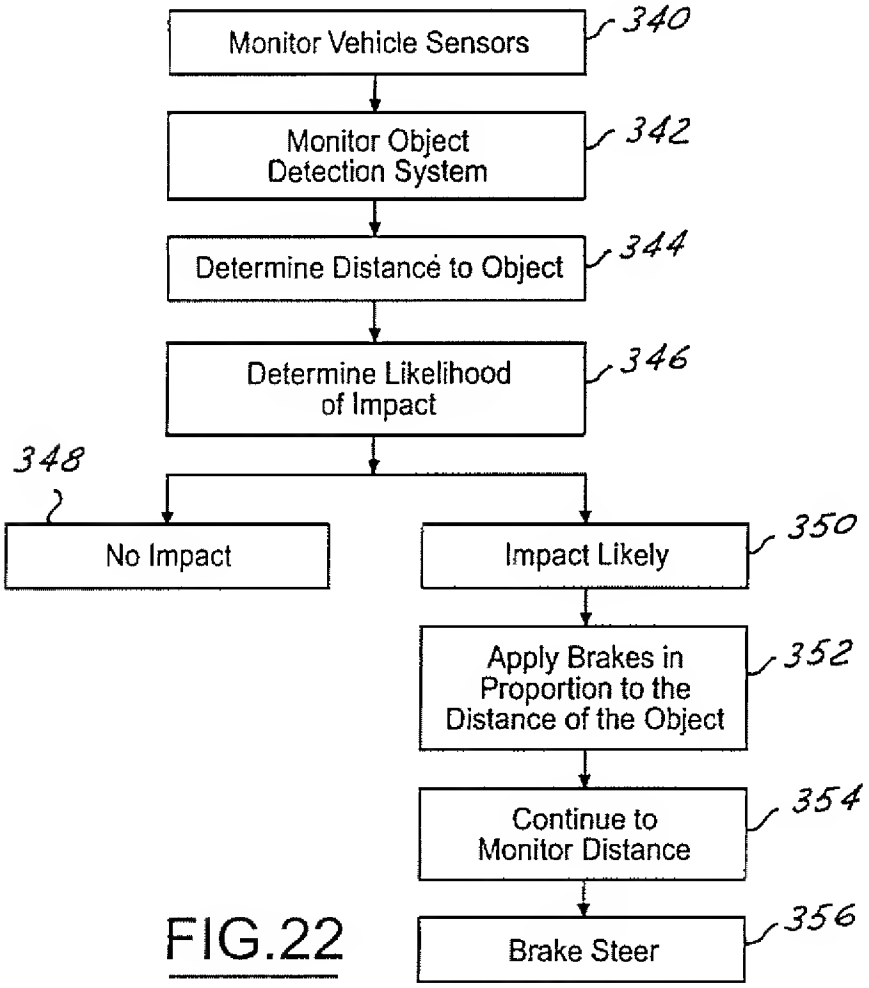

Monitor Vehicle Sensors
340
Monitor Object Detection System
342
Determine Distance to Object
344
Determine Likelihood of Impact
346
348
No Impact
Impact Likely
350
Apply Brakes in Proportion to the Distance of the Object
352
Continue to Monitor Distance
354
Brake Steer
356

FIG.22